

**Operable Unit 1
Fletcher's Paint Works and Storage Facility Superfund Site
Milford, New Hampshire
United States Environmental Protection Agency – Region 1
CERCLIS No. NHD001079649**

**Technical Memorandum – Comparison of Low-Temperature Thermal
Desorption and Off-Site Disposal Remedies**

**June 12, 2007
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1. Executive Summary

On September 30, 1998, the United States Environmental Protection Agency (EPA) issued a Record of Decision (ROD) for Operable Unit 1 (OU-1) of the Fletcher's Paint Works and Storage Facility Superfund Site (the Site) in Milford, New Hampshire. For OU-1 soils, the ROD specified a remedy of excavation and on-site low-temperature thermal desorption (LTTD) treatment of approximately 28,900 cubic yards (cy) of soil impacted primarily with polychlorinated biphenyls (PCBs). This ROD volume estimate has since been refined through completion of the 60 percent (%) design phase, and the remedial excavation volume is currently estimated at 25,460 cy with an additional excavation volume of 3,675 cy required for installation of an engineered cover system and establishment of utility and tree planting corridors. This Technical Memorandum compares the LTTD soil remedy selected in the ROD to an alternate soil remedy of excavation and off-site disposal (OSD) and determines that the OSD soil remedy presents fewer impacts of shorter duration while achieving the same level of protectiveness of human health and the environment as the LTTD soil remedy. Further, the estimated cost of the LTTD remedy is almost 45% more than the estimated cost of the alternate OSD soil remedy.

1.1 Purpose and Scope

Pursuant to the Remedial Design Work Plan (RD Work Plan) (Blasland, Bouck & Lee, Inc. [BBL], April 2005), approved by EPA with modifications on August 18, 2005, the General Electric Company (GE) prepared and submitted a Preliminary (30%) Design Report (Preliminary Design Report) for the LTTD remedy on November 29, 2005. After several modifications, the Preliminary Design Report was approved by EPA with modifications on April 5, 2007, which triggered preparation of Intermediate (60%) Design Reports (Intermediate Design Reports) for both the LTTD and alternate OSD remedies. The Intermediate Design Report for the LTTD remedy was submitted to EPA on June 4, 2007 and the Intermediate Design Report for the OSD remedy is being submitted to EPA on June 12, 2007, concurrent with this Technical Memorandum. All of these documents have been prepared by ARCADIS BBL (formerly BBL) on behalf of GE, and as the Supervising Contractor approved by EPA for the remedial design activities. As anticipated by EPA in its August 18, 2005 correspondence approving the RD Work Plan, the formats and levels of detail of the two Intermediate Design Reports are identical so that "EPA [can] compare issues of importance and similarity to these two designs at the appropriate level of detail."

The purpose of this Technical Memorandum is to provide a comparison of the LTTD and OSD remedies. This Technical Memorandum includes:

- Summaries of the major components of both remedies;
- A comparison of the relevant technical, implementation, and schedule factors associated with each remedy; and
- An evaluation of the LTTD and OSD remedies applying the nine criteria for remedial alternatives evaluation specified in the National Contingency Plan (NCP).

1.2 Remedial Elements

In its ROD, the EPA established soil cleanup levels (SCLs) for the OU-1 portion of Site. These performance standards are summarized in Section 1.4.2 of the Intermediate Design Reports, and apply equally to the LTTD and OSD remedies. Likewise, the ROD set interim cleanup levels (ICLs) for OU-1 groundwater, and selected monitored natural attenuation as the groundwater remedy until achievement of the ICLs. Thus, the groundwater portion of the remedial action selected in the OU-1 ROD would be the same for either the LTTD or the OSD soil remedy.

In general, the LTTD soil remedy includes the following major work activities:

- Excavation and handling of soil and debris at both the Elm and Mill Street Areas;
- Transportation of excavated soils and debris from the Mill Street Area to the Elm Street Area;
- On-site thermal treatment of excavated materials from the Elm and Mill Street Areas in an LTTD facility located at the Elm Street Area near Keyes Park (including over a portion of Keyes Drive);
- Temporary storage of treated soils in soil stockpile areas to be constructed in Keyes Park;
- Off-site disposal of materials not amenable to LTTD treatment, including LTTD treatment residuals;
- Transportation of treated soil to the Mill Street Area; and
- Backfilling and site restoration of both the Elm and Mill Street Areas.

In contrast, the OSD soil remedy includes the following major work activities:

- Excavation and handling of soil and debris at both the Elm and Mill Street Areas;
- Off-site disposal of soil and debris from both the Elm and Mill Street Areas; and
- Backfilling and site restoration of both the Elm and Mill Street Areas.

The specific phases of each major work activity are more fully described in Section 2.

1.3 Remedy Comparison

As presented in the Intermediate Design Reports for both the LTTD and OSD soil remedies, implementation of either remedy is technically feasible. Both remedies entail significant engineering challenges relating to the limited size and surroundings of the Site.

However, the LTTD soil remedy would take far longer than the OSD soil remedy, and result in more intense and prolonged visual, noise and other impacts. The primary reason for this is the method of disposition of much of the excavated material in the case of the LTTD soil remedy. Selection between the LTTD and OSD soil remedies will significantly impact the magnitude and/or duration of the following key aspects of the remedial action:

- Schedule;
- Material handling and transportation;
- Traffic diversion;
- Use of Keyes Park;
- Visual impacts;
- Noise impacts;
- Dust, odors and emissions.

These aspects of the LTTD and OSD remedies are contrasted in Section 3.

1.4 Format of Technical Memorandum

The remainder of this Technical Memorandum is provided in three sections. A brief description of the contents of each section is provided below.

- **Section 2 - Remedy Implementation** presents summaries of the various components of the LTTD and OSD soil remedies.
- **Section 3 - Remedy Comparison** provides a comparison of the relevant technical, implementation, and schedule factors associated with each remedy.
- **Section 4 - Comparative Analysis Using NCP Criteria** applies the nine criteria for the analysis of remedial action alternatives specified in the NCP, 40 C.F.R. §300.430(e)(9)(iii), to each remedy.

2. Remedy Implementation

2.1 General

Implementation of either remedy will involve site preparation, excavation, material handling, and off-site disposal. The LTTD remedy also includes on-site thermal treatment of much, but not all, of the excavated materials. It is anticipated that on-site treatment of excavated materials will require several ancillary activities related to site preparation, mobilization, construction, demobilization of the LTTD facility, pre-operational performance testing, material screening and segregation, and laboratory analysis of treated soils, all of which would contribute to a significant increase in the time necessary to implement the LTTD soil remedy relative to the OSD soil remedy. The major work activities associated with each remedy are presented in the following table:

Work Activity	LTTD Soil Remedy	OSD Soil Remedy
Site Preparation	X	X
Excavation	X	X
Material Handling	X	X
Off-Site Transportation & Disposal	X	X
On-Site Thermal Treatment	X	
Backfilling & Restoration	X	X

The remainder of this section describes each of these work activities and provides a description of how the work activity is incorporated in the LTTD and OSD soil remedies.

2.2 Site Preparation

Although site preparation activities are required for implementation of either remedy, the LTTD remedy will require the performance of additional site preparation activities that will be more extensive and will result in an increased schedule for remedy implementation. The additional site preparation activities required in connection with the LTTD soil remedy would include:

- Pre-excavation of soils – Because excavation activities will occur across the entire Elm Street Area, approximately 4,820 cy of material would need to be pre-excavated and backfilled prior to the construction of the LTTD facility to avoid the need to move the entire LTTD facility and associated ancillary equipment during the performance of the LTTD soil remedy.
- Construction of a temporary access road – The LTTD remedy includes the staging of the treatment facility and ancillary equipment along and over a portion of Keyes Drive (see Technical Drawing G-7 of the Intermediate Design Report for the LTTD remedy). To facilitate contractor access to Keyes Park and implementation of this remedy, construction of a temporary access road would be required to the immediate west of Keyes Drive.

- Material and equipment staging areas - Various material and equipment staging and handling facilities would need to be erected in Keyes Park to support the LTTD operations along with associated fencing and other security and control measures (see Technical Drawing G-9 of the Intermediate Design Report for the LTTD remedy).
- Mobilization and construction of the LTTD facility and ancillary equipment – Following completion of the pre-excavation and temporary access road construction activities described above, several equipment pads (geotextile and gravel pads) would need to be constructed for the LTTD facility and associated ancillary equipment, followed by mobilization and construction of the LTTD facility and the ancillary equipment.
- Pre-operational performance testing – The LTTD facility requires certain pre-operational activities prior to full-scale operation. These activities include: performance of a pre-test; clean and impacted soil shakedown; performance testing including sample collection, analysis, and reporting; and post-performance testing.

2.3 Excavation

Unlike the site preparation activities described above, the limits and scope of the excavation activities are the same for both the LTTD remedy and the OSD remedy. The significant difference between the LTTD remedy and the OSD remedy with respect to how the excavated material is handled and treated, and the negative impacts arising from the handling and treatment of excavated material in connection with the LTTD remedy, are discussed in subsequent sections. The excavation activities common to both remedies are outlined in this section.

The ROD indicates that approximately 28,900 cy of material is subject to excavation and LTTD treatment. Revised limits of excavation and soil removal volumes are presented in the two Intermediate Design Reports. As documented therein, the extensive pre-design investigation (PDI) resulted in a revised soil volume to be excavated in connection with either the LTTD remedy or the OSD remedy of approximately 25,460 cy – 8,580 cy to be excavated at and near the Mill Street Area and 16,880 cy to be excavated at and near the Elm Street Area. In addition, approximately 3,675 cy of additional material will be excavated at the Elm Street Area to install the engineered cover system and establish utility and tree planting corridors, but this additional material does not require treatment or off-site disposal.

The limits of excavation at the Elm and Mill Street Areas will require the performance of deep excavations (i.e., up to 23 feet below grade) very close to, or within, existing features such as roadways, railroad tracks, and other neighboring properties. Specifically, in order to achieve the SCLs, it will be necessary to close Mill Street and Keyes Drive, and partially close Elm Street. The excavation limits in the Intermediate Design Reports also require removing one of the two rail lines on a protracted basis (i.e., several months).

Excavation activities will require a number of controls to ensure the safety of the community, site workers, and adjacent structures. These excavation controls will include: fixed structural supports and/or excavation sideslope grading to stabilize the excavations; dewatering to lower the water table to excavate deep soils at and near the Mill Street Area; water treatment to manage the groundwater removed during dewatering; and diversion of road, rail, and pedestrian traffic away from the work areas.

While the sequencing and scheduling of material handling activities is anticipated to vary between the two remedies (discussed in the section below), the final horizontal and vertical limits of excavation, the structural excavation supports and excavation sideslope grading techniques, and construction equipment anticipated to be used to excavate impacted materials, will be the same regardless of whether the LTTD or OSD remedy is implemented.

2.4 Material Handling

Unlike the excavation activities described above, the material handling processes for the LTTD and OSD soil remedies differ significantly. In general, the LTTD remedy will require more steps to move and stockpile material at the Site, both before and after treatment, while the OSD remedy will involve a simpler process of loading and transporting excavated material to the appropriate off-site disposal facility. Such differences in material handling contribute to the construction schedule for implementing the OSD soil remedy being notably shorter than the construction schedule for implementing the LTTD soil remedy. The specific process steps for each remedy are further described below.

2.4.1. Material Handling – LTTD Soil Remedy

Once Mill Street Area soils have been excavated and appropriately dewatered and/or stabilized, those soils will be transported to and stockpiled at various locations at the Elm Street Area. At the Elm Street Area, the soils will be treated in the LTTD facility, and the treated soils will then be transported to Keyes Park where they will be temporarily stockpiled until laboratory analytical results are available that document that the treated soils are suitable for use as backfill at the Mill Street Area. The treated soils will then be transported back to the Mill Street Area to backfill completed excavations. Treated soils that fail to achieve the applicable SCL will be transported back to the LTTD facility on the Elm Street Area for re-processing, re-stockpiling and re-sampling. Following completion of backfilling activities at the Mill Street Area, the soils requiring excavation at the Elm Street Area will be subject to a similar excavation, treatment, stockpiling, sampling, and backfilling process. A more detailed discussion of the specific material handling steps associated with the LTTD soil remedy is presented below.

Step 1 – Excavation, Transportation, and Stockpiling of Soils

As materials are excavated they will be stockpiled at the Elm Street Area for subsequent screening activities. In the case of the soils excavated at the Mill Street Area, this will typically require direct loading of excavated soils into dump trucks and transportation to the Elm Street Area. When excavated material cannot be directly loaded to transportation vehicles, temporary lined staging areas may be utilized at the Mill Street Area. Given that the rate of soil treatment will be the controlling factor for implementation of the LTTD remedy (i.e., soil excavation and transportation rates are greater than LTTD soil processing rate), it is anticipated that soil excavation and intra-town transportation will be performed intermittently, and will typically be performed during normal work hours, during which time a sufficient stockpile of excavated soils will be created at the Elm Street Area to enable the LTTD facility to continue processing soils throughout the 12 hour operating day.

At the Elm Street Area, the excavated soils will be moved between stockpiles/screening areas using standard construction equipment (e.g., front end loader). When the capacity to stockpile soils at the Elm Street Area is reached, excavation and transportation of soils will cease until some stockpiling capacity is restored. The throughput of the LTTD facility, and the need to reprocess treated soils, will be controlling factors in how fast soils can be excavated and transported for treatment.

Another stockpile will be created at the Elm Street Area to stage excavated soils and other materials that are not amenable to LTTD treatment and will require off-site transportation and disposal.

Step 2 – Screening and Sizing of Excavated Materials

Before treating the excavated materials, it is necessary to screen the excavated material to remove untreatable debris (e.g., boulders, landfill debris, concrete rubble) and reduce the material to the appropriate size for effective treatment. Specifically, excavated material will be rough screened (i.e., 4- to 6-inch screen) to remove the larger debris, with the materials that pass that rough screen placed in a feed soil stockpile. The rough screened material will then be passed through an additional 2-inch screen when being fed into the LTTD feed system. Materials that fail to pass either screen will be either shredded to a size less than 2 inches, or handled as debris. Screened, impacted soils containing excess moisture will be pre-treated using drying and dewatering methods including blending with drier material, gravity dewatering, and air drying. Finally, all segregated/untreatable materials will be stockpiled separately, and subject to waste characterization, management, and transportation to an appropriate off-site disposal facility. As noted above, it is estimated in the Intermediate Design Report for the LTTD soil remedy that approximately 2,960 cy of excavated material will not be treatable in the LTTD facility. This material will be temporarily stockpiled and transported off-site for disposal.

In addition, it is estimated that approximately 7,400 cy of material associated with LTTD facility staging pad materials will require off-site disposal upon completion of thermal treatment activities. Furthermore, the LTTD remedy also involves the off-site disposal of LTTD residual wastes including off-gas particulates, spent baghouse filters, purged quench water, organic condensate, wastewater treatment sludge, spent granular activated carbon, and other miscellaneous wastes. In total, the LTTD remedy will require off-site transportation and disposal of an estimated 10,360 cy of soil (untreatable soil and staging pad material) plus the various other residual wastes.

Step 3 – Processing, Stockpiling, and Testing of Soils

Once screened and sized, the segregated, treatable soils will be processed in the LTTD facility. Once treated, the soils will require testing to document that the applicable SCL has been achieved before the treated soil is used as backfill at the Elm or Mill Street Areas. This will result in additional stockpiles of treated soil, which will be staged in Keyes Park, as shown in Technical Drawing G-9 of the Intermediate Design Report for the LTTD remedy. Separate stockpiles of treated soils will be created representing “batches” of soil for which confirmation samples will be collected. The confirmation samples will be submitted to an analytical laboratory for analysis to confirm that the treatment process has achieved the applicable SCL.

Test results may indicate that the applicable SCL was not achieved for any one of a number of reasons including PCB concentration, moisture content, gradation of the soils fed into the LTTD system, the treatment temperature, the soil processing rate, or other variables. In these cases, the entire batch of treated soil will be returned to the untreated soil stockpile to await re-processing, re-stockpiling and retesting. This in turn will adversely affect the rate at which excavated soils will be able to be transported to the LTTD for treatment.

Be it analytical turnaround time, re-processing of soils, or both, this step in the overall LTTD process has a great potential for significant schedule impacts that will prolong the overall remedy. In this regard, the preliminary construction schedule presented in Appendix G of the Intermediate Design Report for the LTTD soil remedy, and summarized herein, is based on the assumption that the treatment efficiency for the LTTD system will be 100%, meaning that no treated soils will need to be transported back to the LTTD facility for re-processing.

Finally, treated soils that are confirmed through sampling as having achieved the applicable SCL will be removed from the treated soil bins in Keyes Park, transported to the Elm or Mill Street Area, and placed directly into open excavations or in another stockpile for subsequent backfilling activities.

Step 4 – Transport and Backfill of Treated Soils

As illustrated on Technical Drawings G-13 and G-14 in the Intermediate Design Report for the LTTD remedy, the Mill Street Area has been divided into 22 separate excavation cells, while the Elm Street Area has been divided into 58 separate excavation cells. Upon confirmation that the limits of removal have been achieved in each excavation cell or group of excavation cells, backfilling operations can proceed. When needed to backfill a completed excavation, the treated soils will be transported from the treated soil stockpiles located in Keyes Park back to the Elm or Mill Street Areas where these soils will be used as backfill material.

Step 5 – Supplemental Clean Backfill

As previously discussed, approximately 2,960 cy of excavated materials which are not amenable to LTTD are expected to be generated during the LTTD soil remedy and transported for off-site disposal. In addition, the volume of treated soil available for reuse as backfill will be reduced by the treatment process and compaction of the treated soils in the excavations as backfill. It is estimated that the volume loss attributed to the generation of LTTD process residuals and compaction of treated soil backfill could be as high as 10% of the volume of excavated and treated material, or approximately 2,618 cy. As a result, it will be necessary to supplement the treated soil backfill with additional backfill totaling approximately 5,578 cy. However, it is estimated that the sand cap placed over the former building slab at the Elm Street Area will provide approximately 1,000 cy of clean backfill material. Therefore, using the excavation volumes specified in the Intermediate Design Report for the LTTD soil remedy, up to 4,578 cy of clean backfill from an off-site fill source will be required to restore the excavations.

To avoid cross-contamination, the backfill trucks will dump clean backfill in a designated area outside of the exclusion zone at the Elm and Mill Street Area. From there, excavation equipment will transfer these soils into the excavation for placement. A sufficient stockpile of backfill soils will be maintained in these areas to provide sufficient backfill volumes as the excavation cells are cleared through confirmatory sampling.

2.4.2. Material Handling – OSD Soil Remedy

The limits and scope of soil removal and volume of soil subject to excavation would not change for the OSD soil remedy. However, if all of the excavated material is transported for off-site disposal, the excavation activities (and, therefore, the OSD remedy) will require significantly less time to complete. As a result, implementation of the OSD remedy will eliminate the need for most of the material handling activities described above, including post-treatment confirmatory sampling. In addition, the OSD remedy would allow concurrent excavation activities at the Elm and Mill Street Areas, further shortening the duration of the remedial action and consequent disruptions to the Town of Milford (Town). Additional details regarding the schedule for remedy implementation are provided in Sections 3 and 4, while a more detailed discussion of the specific material handling steps associated with the OSD remedy is presented below.

Step 1 – Excavation and Loading Trucks for Off-Site Disposal

The excavation and direct loading of excavated material into trucks for transportation to appropriate off-site disposal facilities will generally be performed as a single, integrated operation. Excavation productivity will be significantly increased under the OSD remedy.

Excavation and direct loading activities will be coordinated to facilitate the availability of sufficient truck capacity so as to allow the excavation to proceed at a steady pace. This will be done by pre-scheduling trucks to meet anticipated daily excavation volumes. Toward that end, two staging areas for transportation vehicles have been identified so that those vehicles may be routed to the Site as needed to maintain a steady excavation and loading rate and to avoid congestion at the Site. These staging areas would also be used for vehicles transporting backfill from an off-site source to the Mill and Elm Street Areas.

Step 2 – Delivery of Backfill

Rather than treating and re-using treated soils as backfill, the completed excavations will be backfilled using clean fill from a local source. Trucks containing backfill will use the same two travel routes to the Site as trucks transporting excavated material from the Site for off-site disposal. These routes are identified in the Truck Route and Traffic Analysis Report included in Appendix E of each Intermediate Design Report.

To avoid cross-contamination, the backfill trucks will dump clean backfill in a designated area outside of the exclusion zone at the Elm and Mill Street Areas. From there, excavation equipment will transfer these soils into the excavation for placement. A sufficient stockpile of backfill soils will be maintained in these areas to provide sufficient backfill volumes as the excavation cells are cleared through confirmatory sampling.

2.5 Off-Site Transportation and Disposal

Both remedies involve off-site disposal of excavated material. The only distinction is the volume of material requiring off-site disposal. The LTTD remedy involves the transportation and off-site disposal of approximately 2,960 cy of excavated soil not treatable in the LTTD facility. In addition, it is estimated that approximately 7,400 cy of material associated with LTTD facility staging pad materials will require off-site disposal upon completion of thermal treatment activities. Furthermore, the LTTD remedy also involves the off-site disposal of LTTD residual wastes including off-gas particulates, spent baghouse filters, purged quench water, organic condensate, wastewater treatment sludge, spent granular activated carbon, and other miscellaneous wastes. In total, the LTTD remedy will require off-site transportation and disposal of an estimated 10,360 cy of soil (untreatable soil and staging pad material) plus the various other residual wastes. In contrast, the OSD remedy involves off-site disposal of approximately 25,460 cy of excavated material.

In either case, materials requiring off-site disposal will be characterized for disposal in accordance with local, state and federal disposal requirements. Based on this characterization, the materials will be transported to an appropriate off-site disposal facility, including permitted hazardous and non-hazardous waste disposal facilities.

2.6 On-Site Thermal Treatment

Only the LTTD remedy involves the on-site thermal treatment of excavated soils. A detailed description of the thermal desorber is provided in the Intermediate Design Report for the LTTD soil remedy. The LTTD facility includes: diesel-powered generators; multiple conveyor systems; mechanical screening devices; air emissions control systems and stacks; water cooling, collection and treatment systems; on-site fuel storage; and various other components. All these components will be mobilized to and staged at the Elm Street Area except for fuel storage which will include a 15,000 gallon propane storage tank to be installed in Keyes Park. The LTTD unit will occupy approximately one-third (1/3) of an acre or about 25% of the Elm Street Area. However, it should be noted that this estimate is associated with only the footprint of the LTTD facility itself. Additional space for construction equipment and access/egress of construction vehicles will be required along the perimeter of this area. In addition, as the area designated for the LTTD facility will occupy a portion of Keyes Drive, a temporary access road will need to be constructed to the west of the existing Keyes Drive by cutting into the existing embankment.

Once the LTTD facility is constructed, it will be subject to a performance testing period, which generally includes equipment shakedown, a pre-test and the performance test. Initially, this will entail running the LTTD system using “clean” soils to evaluate the operating systems. Next, approximately 1,000 cy of excavated soils from the Mill Street Area will be introduced into the system to test and evaluate the operating parameters necessary to achieve the appropriate level of treatment, both for soils and for air emissions. Depending upon a number of variables, it is anticipated that it will take up to three months to complete the performance test period, culminating in the submittal of a performance test report.

As part of the performance test, the resulting data will be analyzed and operating parameters for full-scale operation will be established. Proposed operating parameters will be submitted to the EPA to document that the unit is operated in accordance with the substantive emission requirements. Depending upon the results of the performance testing and the EPA's review of the performance test data, this process may require only several weeks to complete, or, based on experience at some other sites, it may require several months to resolve potential operational questions and requirements. Once the operating parameters have been established and approved, the full-scale treatment process will commence. Based on input from the Town, LTTD operations will occur on a 12 hours per day, 6 days per week (12/6) schedule. A three month winter shutdown period is also anticipated for the LTTD system.

In general, the thermal treatment of excavated soils will consist of the following activities. Excavated materials are first subjected to a mechanical screening process, the screened soils will then be continuously fed into the thermal desorber, which is a refractory lined furnace with an internal rotating drum. The specific sizes of these units vary, but, in general, the inner rotating drum is approximately 5 feet in diameter and 50 feet long. The soils are indirectly heated by conduction and radiation of heat from the drum walls. During this process, heated air is passed through the unit at temperatures ranging to 1,000 degrees Fahrenheit (°F). The precise temperature required to meet the established SCLs will be determined as part of the performance testing. The high temperatures, in combination with the constant agitation of the soils as they pass through the cylinder, result in separation of adsorbed and entrained organic chemical constituents from the soil into a moisture-laden vapor. This vapor is captured and collected within a closed ventilation system, which attaches to the emission control system where these vapors are converted into a liquid form known as condensate. This condensate is processed in the condensate treatment system consisting of phase separators, solids dewatering and an aqueous phase activated carbon system. Residual wastes (e.g., organic liquids, solids) are placed into drums for off-site disposal at a licensed off-site facility. In the meantime, the treated soils continue through the thermal desorber and exit at the "downstream" end of the cylinder.

The treated soils that come out of the thermal desorber fall onto a continuous conveyor belt. At this point, the soils are still very hot and are also very dry. The exit conveyor will be in a shrouded area where water is then sprayed on the treated soils both to cool and re-moisturize the treated soils, the latter of which helps to prevent airborne dust (which can be an issue due to the extreme dryness of the treated soils). From here, the soils are transferred to the treated soil stockpiles that would be located in Keyes Park, where they would accumulate in 400 cy "batches" pending receipt of analytical results. Treated soils that meet the applicable SCL would be used for backfilling. Treated soils that fail to meet the applicable SCLs would be returned to an untreated soil stockpile for re-processing through the LTTD system.

2.7 Backfilling and Restoration

Backfilling of excavations will generally be performed concurrently with the execution of either remedy. Backfilling of excavations under the OSD remedy will consist of importing clean fill, and either placing it directly into excavation cells or stockpiling the fill in a designated location and transporting the clean fill to open excavation cells for backfilling once the limits of excavation within a given cell or group of cells have been confirmed. Similarly, under the LTTD remedy, treated soils that have been analyzed and documented as achieving the applicable SCLs will be transported from the treated soil staging bins to an excavation cell or group of excavation cells, or to a temporary stockpile and subsequently

transported to open excavation cells for backfilling once the limits of excavation within a given cell or group of cells have been confirmed. As discussed earlier, treated soils will be supplemented with imported clean fill, as necessary to complete the backfilling. Additional details regarding backfilling and restoration operations are provided in the two Intermediate Design Reports. Regardless of whether the OSD or LTTD remedy is implemented, backfilling and restoration operations will likely be identical under either scenario other than schedule constraints controlled by other process steps described above.

3. Remedy Comparison

3.1 Technical Ability to Complete

Implementation of either the LTTD or OSD remedy is technically feasible. Both remedies present significant engineering challenges involving the limited size of the Site and the impact of the associated space constraints on material handling. However, these challenges are more severe for the LTTD soil remedy, resulting in greater impact to the schedule for implementation of the LTTD remedy.

The difference between the LTTD and OSD remedies will manifest itself with respect to the following key aspects of the remedial action.

- Schedule
- Transportation
- Traffic Diversion
- Keyes Park
- Visual Impacts
- Noise Impacts
- Dust, Odors, and Emissions

A detailed discussion of these key aspects follows.

3.2 Schedule

The Intermediate Design Reports for both the LTTD and OSD remedies include detailed schedules that reflect the design information presented. Figure 1 presents a side-by-side comparison of the major schedule elements for both remedies. Outlined herein is discussion and comparison of the schedule elements for the two remedies.

3.2.1. LTTD Remedy Implementation

As part of the Intermediate Design Report for the LTTD remedy, BBL has estimated that the on-site portion of the LTTD remedy will take approximately 30 months to complete. For comparison purposes, the following six subtasks were identified as the major construction components of the LTTD remedy:

- Mobilization and general site preparation;
- Installation of excavation support systems;
- Mobilization, set up and testing of the LTTD facility;
- Full-scale thermal treatment (12 hours per day; 6 days per week);
- Decontamination/demobilization; and
- Site restoration.

As a result of this evaluation, an “estimated baseline schedule” for each phase of the LTTD alternative identified above was developed. This schedule is based on experience at numerous sites at which excavation was a key element of the remedial action. This evaluation also estimates the “potential schedule growth,” the additional time it may take to finish a task due to issues specific to that phase, which is also based on experience at those same sites. The “estimated baseline schedule” discussed below includes only the construction phase of the LTTD remedy (outlined above) that will occur at the Site and is based on the construction schedule provided in the Intermediate Design Report.

a. Mobilization and General Site Preparation

This phase includes installing/improving site utilities, fencing, security measures, signage and other miscellaneous fixtures. Site preparation also includes mobilization and setup of site office trailers and support facilities, as well as setting up staging areas and material/equipment storage areas. Also, other preliminary site preparation and coordination activities will be completed during this period.

Estimated baseline schedule: 2 months

Potential schedule growth: 1 month due to incidental delays in, or restrictions on, site access or delays in contractor, equipment, and/or material availability

Estimated schedule range: 2 to 3 months

b. Installation of Excavation Support Systems

Excavation at the Elm and Mill Street Areas to the removal limits identified in the Intermediate Design Report will require several types of excavation support and protection including soldier piles and lagging, steel sheeting, soldier pile tremie concrete (SPTC) walls, and excavation sideslope grading. Before structural excavation supports can be installed, underground utilities will need to be re-routed or modified, oversized materials (tanks, resinous material, and other large debris) identified and excavated, adjacent structures reinforced, and traffic patterns on adjacent roadways modified. A variety of installation techniques will likely be used for the various structural supports. Where installation of structural excavation supports is not required, construction slopes will be graded consistent with the design documents to achieve stable excavation configurations. In areas where the depth of excavation is at or below the water table, groundwater will be managed utilizing extraction wells and/or sumps with pumps, where required. This also includes installation, startup and operation of a temporary groundwater treatment system, as described in the Intermediate Design Report.

Estimated baseline schedule: 3 months

Potential schedule growth: 2 months due to unanticipated subsurface obstructions, excessive utility interference, increased groundwater flow into the excavation cells, and/or increased excavation area

Estimated schedule range: 3 to 5 months

c. Mobilization, Set Up and Testing of LTTD Facility

Once structural excavation supports have been installed and the corresponding installation equipment has been removed, the LTTD facility will be erected at the Elm Street Area. This will include several activities, including pre-excavating and restoring the portion of the Elm Street Area designated for LTTD operations, constructing a temporary access road immediately west of Keyes Drive, construction of the LTTD facility, and start-up activities (e.g., mechanical shakedown, clean soil shakedown, impacted soil shakedown, pre-test, performance test, and preparation/submittal of corresponding documentation to EPA for review and approval).

Estimated baseline schedule: 6 months

Potential schedule growth: 2 months due to equipment delays (e.g., schedule overruns on other projects, which affects equipment availability), and delays associated with start up and acceptable performance testing results

Estimated schedule range: 6 to 8 months

d. Full-Scale Thermal Treatment

The schedule for full-scale thermal treatment will depend on the “productivity” of the LTTD facility. Based on experience and knowledge of thermal treatment systems, the typical throughput for commercially-available LTTD systems ranges from 5 to 20 tons per hour. However, throughput is very site-specific and depends on feed soil moisture content, treatment temperature, types of contaminants, cleanup standards, soil type and other factors evaluated as part of the performance test. The average daily production rate achieved over time determines the total length of time it takes to treat a given quantity of soil. The average daily production rate is a function of the throughput, operating factor (actual operating time versus the total available operating time), and daily and weekly operating schedules (hours per day and days per week, respectively). (It is also a function of the treatment efficiency, the percentage of soil that does not require re-treatment to meet the applicable SCLs. However, for the purposes of the intermediate design, the treatment efficiency of the LTTD system was assumed to be 100%.) As documented in Table 11 of the Intermediate Design Report, the following operating parameters are anticipated:

Instantaneous soil feed rate: 12 tons per hour – This feed rate is dictated by physical space constraints at the Site, which therefore limits the size of the LTTD facility and the instantaneous soil feed rate.

Operating factor: 74 percent – This factor is consistent with the necessary downtime associated with equipment maintenance. This factor does not include the potential need for re-treatment of soils that do not achieve the SCLs.

Operating schedule: 12 hours per day, 6 days per week.

Based on these assumptions, the average daily production rate is estimated at 107 tons per day. This estimated production rate is subject to modification as more detailed site information is developed, site logistics are finalized, and the shakedown, pre-test and performance test are completed. At an average daily production rate of 107 tons per day, the total number of days of full-scale production operation of the LTTD facility is estimated at approximately 360 days, as detailed in Table 11 in the Intermediate Design Report.

Assuming the LTTD facility is operated 6 days per week, this translates to 15 months of operation. However, it is also assumed that the LTTD facility will not be operational during the winter months. As such, it is assumed that the LTTD facility will be shut down for a period of up to three months (i.e., one winter season).

Estimated baseline schedule: 18 months

Potential schedule growth:

- a) 3 months due to increased volume of excavated material;
- b) 3 months due to reduced soil feed rate and operating factor
- c) 3 months due to increased excavation volume, truck limitations and/or restrictions on working hours

Estimated schedule range: 18 to 27 months

e. Decontamination/Demobilization

Once all site work is complete, the LTTD facility, temporary staging areas, and site support and construction equipment will be decontaminated and demobilized from the Site.

Estimated baseline schedule: 2½ months

Potential schedule growth: 1 month due to repeated decontamination based on wipe sample analytical results; the LTTD facility itself adds to the overall volume of reusable equipment requiring wipe sampling

Estimated schedule range: 2½ to 3½ months

f. Site Restoration

While site restoration technically includes backfilling the open excavations to subgrade elevation, this activity will generally be performed concurrently with excavation and thermal treatment operations. However, once backfilling is completed, site restoration will continue with surface restoration (e.g., asphalt, engineered cover system, vegetation), slope stabilization (e.g., riprap), restoration of roads and utilities, reconstruction of railroad tracks at the Mill Street Area, replacement of groundwater monitoring wells abandoned during excavation, final construction close-out activities, and other restoration activities, which will require additional time following completion of the thermal treatment activity.

Estimated baseline schedule: 4 months (Note: this is in addition to the time period during which backfilling will overlap with the thermal treatment and excavation activities)

Potential schedule growth: 2 months due to protracted project closeout as the remedial contractor completes punchlist and contract obligations

Estimated schedule range: 4 to 6 months

Summarizing the above, the estimated time to implement the LTTD remedy is as follows:

Activity	Estimated Baseline Schedule	Potential Schedule Growth	Extended Duration
Mobilization & General Site Preparation	2 months	1 month	3 months
Installation of Excavation Support Systems	3 months	2 months	5 months
Mobilization and Set Up of Thermal Treatment Equipment	6 months	2 months	8 months
Full-Scale Treatment	18 months	9 months	27 months
Decontamination/Demobilization	2½ months	1 month	3½ months
Site Restoration	4 months	2 months	6 months
Total Estimated Duration – LTTD remedy*	35½ months	17 months	52½ months

*Note: Certain activities will overlap. Therefore, the cumulative duration of the individual line items (as shown above) is slightly more than the net total duration (e.g., the cumulative duration of the baseline schedule is 30 months; however, the net total duration, with overlapping activities, is estimated at 35½ months).

3.2.2. OSD Remedy Implementation

BBL has also evaluated the amount of time it will likely take to accomplish the on-site portion of the OSD soil remedy. As part of the Intermediate Design Report for the OSD remedy, BBL has estimated that the on-site portion of the OSD remedy will take approximately 14½ months to complete. For comparison purposes, the following five subtasks were identified as major construction components of the OSD remedy:

- Mobilization and general site preparation;
- Installation of excavation support systems;
- Excavation and off-site disposal;
- Decontamination/demobilization; and
- Site restoration.

Consistent with the evaluation of the LTDD remedy, we have drawn upon experience at similar sites to develop an “estimated baseline schedule” to complete each phase. The schedule evaluation also estimates the “potential schedule growth.” The “estimated baseline schedule” discussed below includes only the construction phase of the OSD remedy discussed above that will occur at the Site and is based on the construction schedule provided in the Intermediate Design Report for the OSD remedy.

a. Mobilization and General Site Preparation

This phase of the remedy will have the same work activities and durations as the LTDD remedy.

Estimated baseline schedule: 2 months

Potential schedule growth: 1 month due to incidental delays in, or restrictions on, site access or delays in contractor, equipment, and/or material availability

Estimated schedule range: 2 to 3 months

b. Installation of Excavation Support Systems

This phase of the remedy will have the same work activities and durations as the LTDD remedy.

Estimated baseline schedule: 3 months

Potential schedule growth: 2 months due to unanticipated subsurface obstructions, excessive utility interference, increased groundwater flow into the excavation cells, and/or increased excavation area

Estimated schedule range: 3 to 5 months

c. Excavation and Off-Site Disposal

This phase of the OSD remedy will be performed in lieu of the excavation and thermal treatment phases of the LTDD remedy. There are several key distinctions between the LTDD remedy and the OSD remedy. Specifically, the following activities will not be required for the alternate OSD remedy:

- Pre-excavation of soils under the proposed location for the LTDD facility;
- Staging, shakedown, pre-testing, and performance testing of the LTDD facility;
- Transportation of excavated materials from the Mill Street Area to the LTDD facility at the Elm Street Area;
- Screening and segregation of the excavated material;
- Thermal treatment of excavated soils;

- Stockpiling in Keyes Park and testing of treated soils; and
- Transportation of treated soils from the treated soil stockpiles in Keyes Park back to the Elm and Mill Street Areas for backfilling.

Furthermore, as previously discussed, the rate of excavation during implementation of the LTTD remedy will be limited by the treatment rate of the LTTD facility. Excavation activities in connection with the OSD remedy can be performed at a significantly faster rate.

For schedule estimating purposes, it is assumed that tractor-trailer trucks with multi-axle dump trailers will be used for off-site transportation of excavated materials. These trucks generally can haul up to 30 tons (i.e., about 20 cy) of material per load. Based on this capacity, these trucks can be loaded at the rate of approximately two to three trucks per hour. This means that 480 to 720 tons of material (i.e., about 320 to 480 cy) could be excavated and loaded in an 8 hour time period. (Although the schedule included in the Intermediate Design Report for the OSD remedy includes 10 hour work days, it is unlikely that excavation and loading activities will occur continuously throughout the entire 10 hours, as it is assumed that approximately two hours of each day will be utilized for morning site preparation, daily health and safety tailgate meetings, lunch breaks, personnel decontamination activities, and general day-end housekeeping activities). However, as a conservative estimate, it is assumed that approximately 15 trucks will be loaded in a single day, yielding an approximate 450 tons (i.e., 300 cy) per day off-site disposal rate.

Using the volume estimates presented in the Intermediate Design Report, approximately 90 working days will be required for this phase, or approximately 14 weeks based on 6 day work weeks.

Estimated baseline schedule:	3½ months
Potential schedule growth:	3 months due to increased excavation volume, truck limitations and/or restrictions on working hours
Estimated schedule range:	3½ to 6½ months

d. Decontamination/Demobilization

Once excavation and off-site disposal is complete, temporary staging areas, and site support and construction equipment will be decontaminated and/or demobilized from the Site.

Estimated baseline schedule:	2 months
Potential schedule growth:	½ month due to repeated decontamination based on wipe sample analytical results; elimination of the LTTD facility decreases the overall volume of reusable equipment requiring wipe sampling
Estimated schedule range:	2 to 2½ months

e. Site Restoration

This phase of the remedy will have the same work activities and durations as the LTTD remedy.

Estimated baseline schedule: 4 months (Note: this is in addition to the time period that will overlap with the excavation activities)

Potential schedule growth: 2 months due to protracted project closeout as the remedial contractor completes punchlist and contract obligations

Estimated schedule range: 4 to 6 months

Summarizing the above, the estimated duration associated with implementing the OSD remedy is as follows:

Activity	Estimated Baseline Schedule	Potential Schedule Growth	Extended Duration
Mobilization and General Site Preparation	2 months	1 month	3 months
Installation of Excavation Support Systems	3 months	2 months	5 months
Excavation and Off-Site Disposal	3½ months	3 months	6½ months
Decontamination/Demobilization	2 months	½ month	2½ months
Site Restoration	4 months	2 months	6 months
Total Estimated Duration – OSD remedy	14½ months	8½ months	23 months

*Note: Unlike the LTTD remedy, it is not anticipated that activities will overlap each other. Therefore, the cumulative duration of the individual line items (as shown above) is consistent with the net total duration.

3.3 Transportation

There will be an increase in truck traffic in connection with either remedy. This section presents a comparison of the truck traffic that will result from the implementation of the LTTD or OSD remedy.

The LTTD remedy will generate “intra-town” trucking in the material handling and treatment phases. Excavated materials will be transported from the Mill Street Area to a stockpile location at the Elm Street Area where they will be screened and segregated prior to thermal treatment. The treated soils will then be transported to Keyes Park for staging, and eventually transported back to the Mill Street Area for use as backfill. There will also be “intra-site” traffic, particularly the Elm Street Area as trucks and equipment move in and around the LTTD processing equipment and soil stockpile areas located in Keyes Park.

In addition to this “intra-town” and “intra-site” traffic, the LTTD remedy will involve the transportation of untreatable materials (estimated at 2,960 cy), and other LTTD residual wastes to off-site disposal facilities. In total, the LTTD remedy will require off-site transportation and disposal of an estimated 10,360 cy of soil (untreatable soil and staging pad material) plus the various other residual wastes. It is also estimated that up to 2,618 cy of clean fill will be trucked to the Site as part of the LTTD remedy to supplement treated soils for use as backfill. Finally, there will also be a construction vehicle traffic component associated with the mobilization and demobilization of equipment and materials.

By contrast, the OSD remedy will generally entail direct loading of excavated material into vehicles for transportation to an off-site disposal facility. There will be no transport of excavated materials from the Mill Street Area to the Elm Street Area; material excavated from the Mill Street Area would be transported directly off-site for disposal. Once the excavation has been completed, the areas will be backfilled with imported clean fill. This would not involve the transport of materials between the Elm and Mill Street Areas. Rather, backfill would be transported from the off-site source directly to the area (i.e., Elm Street Area or Mill Street Area) where it is needed.

Table 1 presents a projected breakdown of the trucking trips. Note that a trip is defined as one leg of an operation, for example, from the Mill Street Area to the Elm Street Area, or from the off-site backfill source to the Elm Street Area. This table compares the trucking activity for the LTTD remedy with that of the OSD remedy.

Outlined below is an evaluation of the truck cycles for each remedy in combination with the estimated schedule. It should be noted that this estimate does not include truck trips associated with certain miscellaneous activities, including: mobilization, construction, and demobilization of the LTTD facility at the Elm Street Area; mobilization, construction, and demobilization of the temporary water treatment facility at the Mill Street Area; mobilization and installation of excavation support structures; and the personal vehicles of the remedial contractor’s personnel.

LTTD Remedy – It is estimated that approximately 5,354 truck trips will run in the course of the implementation of the LTTD remedy. This number of trips is largely due to the multiple material handling requirements associated with the LTTD remedy. Specifically, roughly 61 percent (3,282 trips) of these trips will be short distance trips (between the Elm and Mill Street Areas), which would likely consist of smaller capacity (e.g., 10 cy) dump trucks. The remaining 39 percent (2,072 trips) represent off-site backfill and disposal trucks entering and leaving Milford. Using the schedule estimates discussed above, this traffic will primarily occur during treatment operations estimated at 460 working days. This translates to an average of 12 truck trips per day during this approximate 18 month period.

OSD Remedy – It is estimated that approximately 4,992 truck trips will be required over the course of implementation of the OSD remedy. In this case, all of these truck trips represent truck trips entering and leaving Milford using the larger capacity (e.g., 20 cy), long-distance dump trailers. Using the schedule estimates provided in the Intermediate Design Report for the OSD remedy, this traffic will primarily occur during the excavation, handling, and off-site transportation/disposal phase of the project, estimated at 90 working days. This translates to an average of 55 truck trips per day during this approximate 3½ month period.

While the LTTD remedy may result in fewer truck trips on a per day basis than the OSD remedy, the time period within which traffic will be adversely affected by this truck traffic is 16 months longer for the LTTD remedy. In addition, nearly all of the truck trips associated with the OSD remedy are off-site instead of the “intra town” trips that account for 61 percent of the truck trips associated with the LTTD remedy. Finally the number and timing of daily truck trips associated with the OSD remedy can be modified as to address community concerns without elongating the schedule for the OSD remedy. The number and timing of daily truck trips associated with the LTTD remedy will not be as flexible due to the need for continuous processing.

3.4 Traffic Diversion

For both remedies, the same amount of soils will be excavated from the Elm and Mill Street Areas. As outlined above, the excavation will extend very close to or within existing infrastructure features, including roadways and a railroad line. The scope of traffic disruptions relating to excavation (as opposed to transportation for treatment or disposal) will be the same for both alternatives. However, the duration of these disruptions will likely be shorter for the OSD remedy, as the LTTD remedy will take significantly longer to implement, as previously described.

Elm Street – Closure of one lane adjacent to the Elm Street site is required to excavate soils beneath the roadway. Two-way traffic will be maintained at all times. Traffic will be maintained in one lane with the use of flaggers or a temporary traffic signal. The west-bound (i.e., northern) lane will be closed only during excavation and pavement replacement operations. Pedestrians will be detoured to the opposite side of Elm Street at the adjacent intersections. Technical Drawing T-3 in the Intermediate Design Report presents the traffic diversion plan for Elm Street to accommodate this lane closure.

Mill Street – Closure of Mill Street is required to excavate the soils and to reconstruct the road. Mill Street traffic will be detoured during this period of time. Technical Drawing T-1 in the Intermediate Design Report presents the traffic diversion plan for Mill Street to accommodate this street closure.

Keyes Drive – Temporary closure of Keyes Drive will be necessary. However, access to the residence at Parcel 25-11, which has a driveway off Keyes Drive, will be maintained during the implementation of either remedy. Keyes Drive will be closed for all other non-project use, including access to the recreational facilities in Keyes Park. The Town is currently attempting to secure alternate access to Keyes Park through private property (i.e., the former Permattach property) that links to Elm Street. Such access would allow continued use of Keyes Park during either remedy.

3.5 Keyes Park

Keyes Park will be affected by both remedies but will be more significantly affected by the LTTD remedy due to both schedule and physical use of space. Figure 2 shows the relative footprint for both remedies, where the major difference that is highlighted is the use of additional space in Keyes Park associated with the LTTD remedy.

LTTD Remedy - As discussed above, temporary closure of Keyes Drive will be necessary due to the required excavation of soils on the west side of the Elm Street Area as well as the placement of the LTTD facility in the northwest corner of the Elm Street Area (including over a portion of Keyes Drive). In addition, the LTTD alternative will require the use of a significant portion of Keyes Park, specifically the entire area located to the south of the ballfield, for the staging of clean fill, treated soil, and clean equipment/material for the duration of LTTD operations. This will also be accompanied by truck traffic in and out of Keyes Park as well as earthmoving equipment to load and move soils within the treated soil staging area. In addition, office trailers, a large propane tank and various support facilities will be located in a portion of Keyes Park (likely near the existing tennis courts), thus reducing existing parking capacity.

OSD Remedy - As with the LTTD remedy, temporary closure of Keyes Drive will be necessary due to the required excavation of soils on the west side of the Elm Street Area. However, the closure will be several months shorter than that caused by the LTTD remedy. In addition, for the OSD remedy, only office trailers and support facilities will be located Keyes Park, though the contingency for using a smaller portion of Keyes Park for support operations has been identified in the Intermediate Design Report. If the contingent area for the OSD remedy is used, it will be accessed directly from Keyes Drive. Thus, the gravel drive located immediately south of the ballfield would be outside of the work area, and still available for use by the Town. With or without the use of the contingent area, the overall extent and magnitude of disruption of Keyes Park is significantly less for the OSD remedy than what will occur with the LTTD remedy, and any disruption that does occur with the OSD remedy will be much shorter than in connection with the LTTD remedy.

3.6 Visual Impacts

Both remedies will have significant visual impacts relating to the excavation and restoration activities that will occur at this highly visible location in the community. The LTTD remedy would present the additional significant visual impacts relating to the construction and operation of the LTTD facility and related material handling facilities. Further, as previously noted, the duration of the significant impacts relating to the LTTD remedy will be far longer than the visual impacts associated with the OSD remedy as a result of the much longer duration of the LTTD remedy.

LTTD Remedy - Visual impacts associated with excavation in connection with the LTTD remedy will include the operation of standard earthmoving equipment within the Site and the movement of trucks along designated haul routes. In general, the following equipment will be readily visible:

- Crane/pile driver (limited to sheetpile and soldier pile installation activities);
- Slurry plant for mixing/desanding slurry used for the SPTC walls at the Mill Street Area;
- Track-mounted excavator(s) and front-end loader(s) to excavate and move excavated soils (throughout the excavation/backfill phases);
- Dump trucks to transport excavated soils from the Mill Street Area to the Elm Street Area for treatment;

- Dump trailers to transport untreatable materials from the Elm Street Area to designated off-site disposal facilities, and to import clean backfill (throughout the excavation/backfill phases);
- Bulldozer(s) to spread clean backfill materials within the excavation areas and perform final grading (during the backfill/restoration phases);
- Compaction equipment to compact backfill (throughout the excavation/backfill phases); and,
- Various pumps, tanks, and support equipment (throughout the project).

In addition, the LTTD remedy will involve the construction and maintenance of the LTTD facility at the Elm Street Area. As described above, the LTTD facility includes machinery to sort, screen, convey, and process the excavated soils, as well as diesel-powered generators, air emissions control systems and stacks, water cooling, collection, and treatment equipment, and other equipment associated with the treatment process. Heavy cranes will be brought on-site to maneuver and set up the system components. In addition, numerous soil stockpiles will be required at the Elm Street Area and at Keyes Park to accommodate excavated soils awaiting screening, screened soils awaiting LTTD treatment, treated soils awaiting confirmation sampling, untreatable materials awaiting off-site disposal, and clean fill to be used as backfill. Also, thermal treatment operations will generate visible steam emissions, most notably during periods of colder weather.

OSD Remedy – The visual and aesthetic impacts for the excavation activities associated with the OSD remedy will be similar to those associated with excavation associated with the LTTD remedy (e.g., construction equipment, excavation support materials). However, none of the visual and aesthetic impacts associated with the LTTD facility will be present. Another significant difference in the visual impacts will be fewer soil stockpiles occupying a smaller area in Keyes Park. In addition, the visual impacts for the OSD remedy will be significantly shorter in duration, as previously discussed.

3.7 Noise Impacts

Both remedies will have significant noise impacts relating to the excavation and restoration activities that will occur at this central location in the community. The LTTD remedy would present the additional significant noise impacts relating to the construction and operation of the LTTD facility and related material handling facilities. Further, as previously noted, the duration of the significant impacts relating to the LTTD remedy will be far longer than the noise impacts associated with the OSD remedy as a result of the much longer duration of the LTTD remedy.

LTTD Remedy – Noise impacts will include noise associated with the following activities: 1) steel sheeting and pile driving; 2) excavation and earthmoving; 3) trucking; and 4) thermal treatment.

- 1.) **Steel Sheeting and Pile Driving** – The excavation component of the work requires sheet piling as well as soldier piles and lagging to be installed at both the Elm and Mill Street Areas. Pile driving will entail use of cranes and pile driving equipment, which creates loud and repetitive sounds due to the pounding and vibration of the piles. It is anticipated that this operation will be generally limited to normal work hours, and will last 3 to 5 months.

- 2.) Excavation and Earthmoving – This operation will use conventional construction equipment including excavators, front-end loaders, and other earthmoving equipment. Noise will be created by the diesel engines as well as the safety signals (e.g., backup alarms). Also, the dewatering pumps at both the Mill and Elm Street Areas will create mechanical noise. It is anticipated that these activities will occur over the entire 25½ to 52½ month duration of the on-site phases.
- 3.) Trucking – Trucks will transport material back and forth between the Elm and Mill Street Areas, as well as Keyes Park. Trucks will also travel in and out of Milford to transport untreatable and/or excess materials, as well as imported clean fill. Noise will be created by the diesel engines as well as the safety signals (e.g., backup alarms). Similar to the excavation and earthmoving described above, it is expected that the trucking and attendant noise will occur over the entire duration of the on-site phases, intensifying during the 18 to 27 month thermal treatment period.
- 4.) Thermal Treatment – The LTTD facility will include equipment which will create noise due to diesel-powered generators, conveyance equipment, grinding operations, mechanical screens, and other electrical/mechanical systems. This operation and its associated noise will occur 12 hours per day, 6 days per week for an estimated 18 to 27 months.

OSD Remedy – There will be noise impacts associated with the OSD remedy that are compared below with the noise impacts associated with the LTTD remedy.

- 1.) Pile Driving – Same noise, schedule and duration as the LTTD remedy.
- 2.) Excavation and Earthmoving – Same noise as the LTTD remedy; however, it will occur over a shorter project duration of 14½ to 23 months.
- 3.) Trucking - Same noise as the LTTD remedy; however, it will occur over a shorter task duration of 3½ to 6½ months.
- 4.) Thermal Treatment – None.

None of the noise impacts associated with the LTTD facility will be present. In addition, the noise impacts for the OSD remedy will be significantly shorter in duration, as previously discussed.

3.8 Dust, Odors, and Emissions

The LTTD remedy will generate dust, odors and emissions resulting from a number of sources including excavation and material handling, engine exhaust and thermal treatment. Likewise, the OSD remedy will generate dust, odors and emissions including the excavation and material handling source and engine exhaust source but will not include any related impact due to thermal treatment.

LTTD Remedy – Dust, odors and air emissions associated with the LTTD remedy will be associated with the following activities: 1) excavation and material handling; 2) engine exhaust; and 3) thermal treatment.

- 1.) **Excavation and Material Handling** – Dust and odor control measures in combination with real-time air monitoring will be established prior to initiation of field work. However, excavation and handling of soils may create dust, as well as other nuisance odors. It is anticipated that the real-time air monitoring will be performed at the upwind and downwind site perimeter during the soil excavation and loading activities. Real-time monitoring will likely be performed for particulate matter (i.e., dust), and volatile organic compounds.

Soil excavation exposes buried soil and other materials, which, when exposed to the atmosphere, may create noticeable odors. This is a particular concern at the Elm Street Area, the former location of a municipal burning dump, which may include partially burned trash, rubbish or other debris, which could create noticeable odors. If odors or the real-time air monitoring concentrations at the downwind site perimeter exceed action levels (to be established during final design) due to site excavation activities, additional emissions controls will be implemented.

The dust and nuisance odors associated with the LTTD remedy will be present through the site preparation, excavation and thermal treatment activities.

- 2.) **Engine Exhaust** – Exhaust fumes will be created by a variety of sources including construction equipment, power generation equipment, trucks, and other gasoline or diesel powered equipment. To some extent, these exhaust fumes will occur throughout the entire duration of the LTTD remedy.
- 3.) **Thermal Treatment** – Thermal treatment will produce stack emissions, which will be controlled by appropriate air pollution control equipment. Appropriate control measures and operating parameters will be established as part of the performance test to document that the thermal treatment activity meets applicable air quality standards. Other emissions include steam and other vapors from the heated soils as they exit the treatment process. Air emissions associated with the thermal treatment system will last for an estimated 18 to 27 months, and will occur 12 hours per day, 6 days per week.

OSD Remedy – There will be dust, odor and air emissions impacts associated with the OSD remedy, which are compared below with the dust, odor, and air emissions impacts associated with the LTTD remedy.

- 1.) **Excavation and Material Handling** – Same general issues as outlined above for the LTTD remedy, except that the overall duration is estimated at 3½ to 6½ months.
- 2.) **Engine Exhaust** – Same general issues as outlined above for the LTTD remedy, except that the overall duration is estimated at 14½ to 23 months.
- 3.) **Thermal Treatment** – None.

Both remedies will have impacts due to dust, odor and air emissions; however, these impacts associated with the LTDD remedy will be greater due to the thermal treatment processes, and the overall impacts will last longer due to the protracted LTDD schedule.

4. Comparative Analysis using NCP Criteria

4.1 EPA Evaluation

Pursuant to Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of the NCP, 40 C.F.R. §300.430(e)(9)(iii), there are different factors that must be considered when selecting site remedies. These factors include nine criteria, as follows:

Threshold Criteria

1. Overall protection of human health and the environment
2. Compliance with applicable or relevant and appropriate requirements (ARARs)

Primary Balancing Criteria

3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility, or volume through treatment
5. Short-term effectiveness
6. Implementability
7. Cost

Modifying Criteria

8. State acceptance
9. Community acceptance

A discussion of each follows.

4.2 Overall Protection of Human Health and the Environment

This criterion considers the adequacy of protection of human health and the environment associated with a site remedy. This includes how risks are managed for various exposure pathways which may be eliminated, reduced or controlled through treatment, engineering controls and/or institutional controls. Attainment of an acceptable level of protection of human health and the environment is a threshold requirement under the NCP.

The overall protection of human health and the environment for the LTTD and OSD soil remedies are compared below.

LTTD Soil Remedy	OSD Soil Remedy
According to the ROD the LTTD remedy would be protective because: <ul style="list-style-type: none">▪ Soils would be treated to below site-specific risk-based cleanup levels established in the ROD.	Off-site disposal would attain the same level of protection of human health and the environment as the LTTD remedy because: <ul style="list-style-type: none">▪ The OSD remedy would achieve the same cleanup levels as the LTTD remedy.

LTTD Soil Remedy	OSD Soil Remedy
<ul style="list-style-type: none">▪ The remedy reduces the risks to human health and the environment by eliminating, reducing or controlling exposures to PCBs through treatment, engineering controls, and institutional controls.▪ The cleanup levels are set to treat soil that could potentially impact the groundwater under the Site in the future.▪ Institutional controls will be exercised, restricting the use of the groundwater, thereby eliminating the future ingestion exposure until natural attenuation processes can reduce the contaminant concentrations in the groundwater to safe levels.▪ A long-term monitoring program will ensure the remedy remains protective of human health and the environment.▪ The remedy will not pose unacceptable short-term risks or cross-media impacts since the technology, while innovative, has been successfully demonstrated at other sites, the work will be phased, and controls will be employed/precautions taken to minimize potential air emissions.	<ul style="list-style-type: none">▪ The OSD remedy reduces the risks to human health and the environment by eliminating, reducing or controlling exposures to PCBs through removal, engineering controls, and institutional controls.▪ The removal of soils to the established cleanup goals will address the potential future impact to groundwater under the Site in the future.▪ The same institutional controls will be implemented as anticipated for the LTTD remedy.▪ The same long-term monitoring program will be implemented as anticipated for the LTTD remedy.▪ Off-site disposal will consist of landfilling at a secure facility those soils with PCB concentrations greater than the soil cleanup levels. Landfilling will not pose unacceptable short-term risks, as it is an established approach that has been implemented successfully at many sites.

Both the LTTD soil remedy and OSD soil remedy are protective of human health and the environment.

4.3 Compliance with ARARs

For a remedy to be acceptable, it must comply with ARARs. Compliance with ARARs is a threshold requirement under the NCP.

Both remedies can be completed in compliance with ARARs. This was first determined by EPA in the ROD. The final design for the LTTD or OSD remedy will expand on this further by inclusion of a detailed analysis and discussion of how ARARs are or will be met, and a statement of assumptions and all plans, drawings and specifications necessary to support the analysis of compliance with ARARs.

4.4 Long-Term Effectiveness and Permanence

This criterion considers the remedy effectiveness over the long term and the degree of permanence it attains. This is a balancing criterion which is used to compare and evaluate the attributes of remedial alternatives that meet the threshold criteria.

The LTTD remedy provides long-term effectiveness and permanence by excavating and treating all soils that could pose a long-term threat to human health and the environment. The OSD remedy provides long-term effectiveness and permanence through excavation of these same soils, and physical removal from the site and community. Once placed in a secure landfill, long-term effectiveness and permanence of this remedy is provided through management within a permitted, secure disposal facility designed to provide adequate and reliable controls.

4.5 Reduction of Toxicity, Mobility or Volume Through Treatment

Reduction of toxicity, mobility or volume through treatment is another balancing criterion that is used to compare and evaluate remedial alternatives.

The LTTD remedy provides for some volume reduction through the on-site thermal treatment processing for that portion of the excavated soils amenable to LTTD treatment. Further, the LTTD remedy reduces toxicity through off-site treatment (incineration) of condensate and other organic wastes generated by the LTTD process. For those impacted soils not amenable to LTTD treatment, there will be a reduction in mobility by placement of these soils into a secure, monitored landfill facility.

While the LTTD remedy addresses this criterion through a combination of volume, toxicity, and mobility reduction, the OSD remedy addresses this criterion exclusively through mobility reduction. Specifically, all of the impacted soils will be placed in a secure, monitored landfill facility where contaminant migration/mobility is carefully contained and monitored.

4.6 Short-Term Effectiveness

Short-term effectiveness is another balancing criterion. Short-term effectiveness considers remedy implementation and any short-term, implementation-related impacts that may be incurred. Many of the issues identified in Section 3 relate to this criterion.

As noted in Section 3, the short-term effectiveness of the LTTD remedy is inhibited by the significantly longer period of time required to implement the LTTD remedy relative to the OSD remedy as well as disruption, visibility, noise, dust, odor and emission impacts relating to the LTTD remedy.

While the OSD remedy also presents certain traffic, disruption, visibility, noise, dust, odor and emission impacts, it will not present any of the impacts, many of which are considerable, relating to the construction and operation of the LTTD facility. On balance, the OSD remedy has a much greater short-term effectiveness than the LTTD remedy.

4.7 Implementability

Implementability is the fourth of five balancing criteria, and considers the technical feasibility of remedy implementation. Like short-term effectiveness, implementability is also particularly relevant to the remedy selection due largely to constraints associated with small size and location of the Site. While challenging, both remedies are implementable. A comparison of the two remedies is outlined below.

LTTD Soil Remedy	OSD Soil Remedy
<p>The LTTD remedy should be technically and administratively implementable but:</p> <ul style="list-style-type: none"> ▪ Because the Elm and Mill Street Areas are small, space is a key consideration. Keyes Park will be needed for staging of clean fill, equipment and construction offices. ▪ All or portions of Mill Street, Elm Street and the Keyes Drive will have to be closed temporarily during excavation. ▪ An active railway borders the Mill Street Area that poses implementation issues to allow work to proceed safely with limited disruption to the railroad. ▪ There is a limited number of LTTD vendors who own and operated the thermal treatment equipment, particularly units appropriately sized for the Site. 	<p>The OSD remedy is implementable from an engineering and technical standpoint but:</p> <ul style="list-style-type: none"> ▪ Off-site disposal is more readily implementable because the issues of procuring, mobilizing, testing and operating the LTTD facility are avoided. ▪ The direct load-out of soils from the excavation areas and the availability of landfill capacity make the off-site disposal option much more quickly and easily implementable. ▪ All or portions of Mill Street, Elm Street and the Keyes Drive will have to be closed temporarily during excavation though for a shorter duration than the LTTD remedy. ▪ An active railway borders the Mill Street Area that poses implementation issues to allow work to proceed safely with limited disruption to the railroad. ▪ A smaller portion of Keyes Park is needed to implement the remedy. ▪ Further, the disruptions caused by excavation (street closures, rail line impacts), will be shorter and, in some cases less severe, because of the shorter duration of the OSD remedy.

Again, both remedies are implementable but the OSD remedy is implementable with fewer and shorter impacts, particularly the absence of the impacts relating to the construction and operation of the LTTD facility, including the need for less area within Keyes Park. In addition, there are very few thermal treatment vendors that can implement the LTTD remedy, so contractor procurement and scheduling may be difficult for the LTTD remedy. Therefore, on balance, this criterion favors the OSD remedy.

4.8 Cost

Cost is a balancing criterion that is used to compare one alternative to another. All other things being equal, preference should be given to the lower cost alternative.

The Intermediate Design Reports for both the LTTD remedy and OSD remedy include a cost estimate to implement each remedy. A summary of these cost estimates is outlined below.

	LTTD Soil Remedy	OSD Soil Remedy
General Site Preparation	\$2,940,000	\$1,590,000
Installation of Excavation Support Systems	\$5,600,000	\$5,600,000
Excavation, Handling and Treatment/Disposal	\$16,420,000	\$10,210,000
Site Restoration	\$1,320,000	\$1,520,000
Other	\$2,520,000	\$1,030,000
	\$28,800,000	\$19,950,000

The cost estimate for the LTTD soil remedy is \$8,850,000 more than the cost estimate for the OSD remedy. Thus, the LTTD remedy is almost 45% more than the OSD remedy. Therefore, on balance, this criterion favors the OSD remedy.

4.9 State Acceptance

State acceptance is considered a modifying criterion that allows for final evaluation and modification of the selected remedial approach following State review.

The State of New Hampshire reviewed the LTTD remedy proposed by EPA during its prior remedy selection process (i.e., in the late 1990s), and indicated its concurrence with that remedy.

The State of New Hampshire will have the opportunity to review and comment on the alternate OSD remedy proposed by GE. It is anticipated that State of New Hampshire concurrence with the OSD remedy will be attained given the shorter and less intense impacts presented by the OSD remedy.

4.10 Community Acceptance

Community acceptance is considered a modifying criterion that allows for final evaluation and modification of the selected remedial approach following community review.

The Town reviewed the LTTD remedy proposed by EPA during its prior remedy selection process (i.e., in the late 1990s), and had indicated its concurrence with that remedy.

The Town will have the opportunity to review and comment on the alternate OSD remedy proposed by GE. It is anticipated that Town concurrence with the OSD remedy will be attained given the shorter and less intense impacts presented by the OSD remedy. It is also expected that the impacted and/or interested members of the community near the Site would favor the OSD remedy for similar reasons.

4.11 Summary

Both the OSD remedy and the LTTD remedy would meet the baseline requirements of being protective of human health and the environment, and complying with ARARs. The balancing criteria, particularly unique short-term effectiveness and implementability issues relating to the construction and operation of the LTTD facility, and the much higher cost of the LTTD remedy, favor the OSD remedy.

Significant considerations include:

1. Short-term effectiveness and implementability issues relating to the LTTD facility – Only the LTTD soil remedy presents the unique short-term effectiveness and implementability issues relating to the construction and operation of the LTTD facility. These issues include increased duration and “intra town” nature of truck traffic, increased and longer duration noise, visual and aesthetic impacts, greater loss of recreational facility use for a longer duration, and the dust, odors, emissions, and other impacts unique to thermal treatment of hazardous waste in a thickly settled community setting.
2. Schedule – The LTTD remedy could take up to 21 months longer (baseline case) to complete relative to the OSD remedy, but could take as much as 29 months longer (extended case) to complete. Put simply, this means that the duration of the impacts associated with both remedies will be on the order of two years longer for the LTTD remedy than for the OSD remedy.
3. Cost – The LTTD soil remedy is estimated to cost \$8,850,000 more than the OSD soil remedy. Thus, the LTTD remedy costs almost 45% more than the OSD remedy.

Because the OSD remedy will result in shorter and less intense impacts to the community, with the same protectiveness of human health and the environment, at a much lower cost, consideration of the criteria specified in CERCLA and the NCP strongly favor the OSD remedy.

Table 1 - Trucking Comparison

OSD Remedy – Off-Site Disposal

Activity	Truck Capacity (cy)	Soil Quantity (cy)	Number of Truck Trips (1)
Mill Street			
Transportation of Excavated Soils to Secure Landfill	20	8,580	858
Transportation of Surface Restoration Materials	20	750	75
Transportation of Clean Backfill	20	7,830	783
Elm Street			
Transportation of Excavated Soils to Secure Landfill	20	16,880	1,688
Transportation of Surface Restoration Materials	20	6,650	665
Reuse Sand Cap	-	1,000	-
Transportation of Clean Backfill	20	9,230	923
TOTALS			4,992

LTDD Remedy - On-Site Thermal Treatment

Activity	Truck Capacity (cy)	Soil Quantity (cy)	Number of Truck Trips (1)
Mill Street			
Transportation of Untreated Soils to Elm Street	10	8,580	1,716
Transportation of Treated Soils from Keyes Park	10	7,830	1,566
Transportation of Clean Backfill and Other Restoration Material to Mill Street	20	750	75
Elm Street			
Transportation of Untreatable TSCA Materials to Secure Landfill	20	2,960	296
Transportation of Clean Backfill to Replace Untreatable TSCA Materials	20	2,960	296
Transportation of Excess Treated Soils due to Material Balance	20	7,400	740
Transportation of Clean Backfill and Other Restoration Material to Elm Street	20	6,650	665
TOTALS			5,354

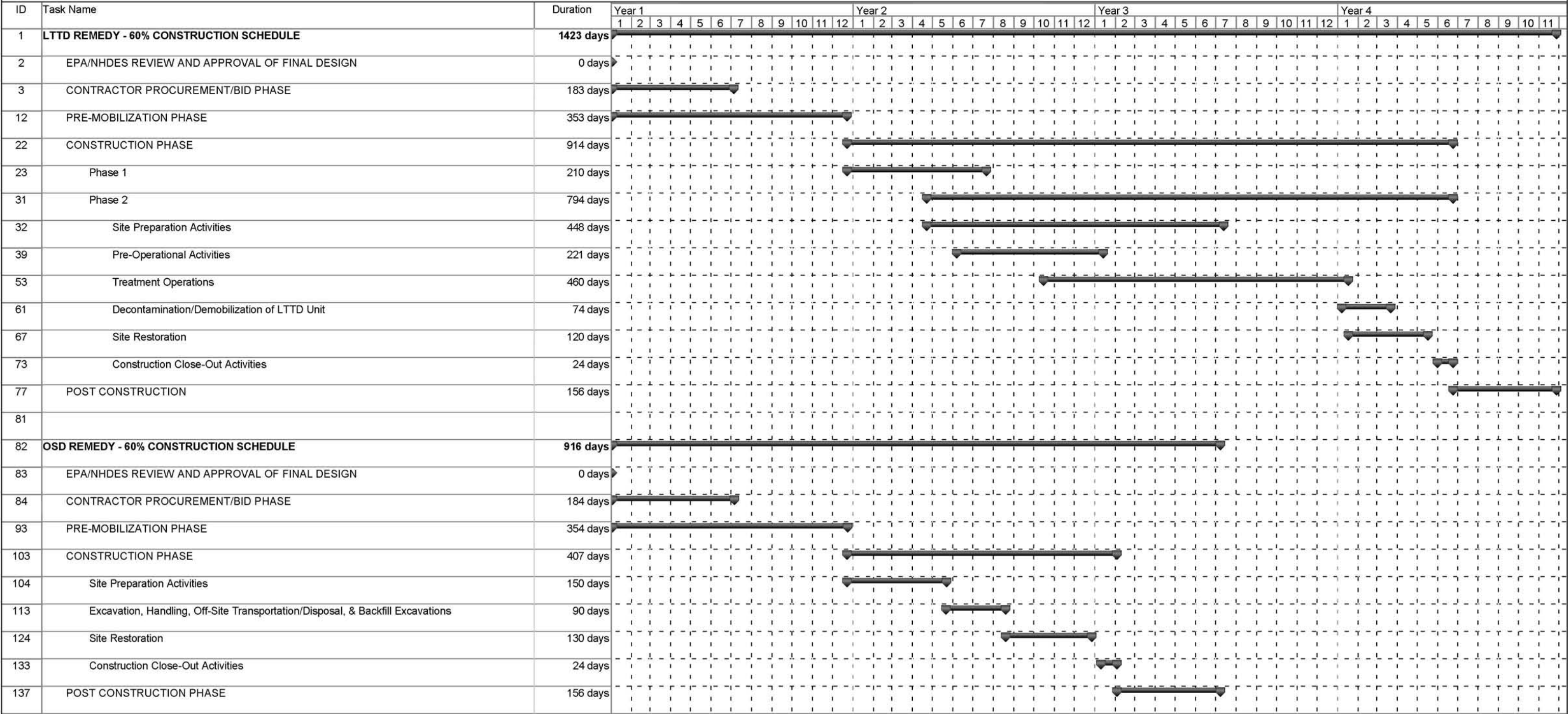
Notes and Assumptions to Table 1:

1. The number of truck trips was calculated by assuming that every time soils were moved, two truck trips were required. For example, under the LTDD remedy, to transport soils from Mill Street to Elm Street would require two truck trips (one trip to take the soils from Mill Street to Elm Street for treatment, and one trip to return to Mill Street to collect another load of soil).
2. 10 cy capacity dump trucks would be used to shuttle soils between Mill and Elm Streets for the LTDD remedy, and 20 cy capacity dump trucks would be used to transport soils directly to the landfills and to haul backfill to the Site.

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Figure 1 - Preliminary (60%) Project Construction Schedule - Remedy Comparison



See Appendix G of the Intermediate Design Reports for the LTTD and OSD soil remedies for more detailed information on the preliminary construction schedule for each remedy.

